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8.16 PALEONTOLOGICAL RESOURCES

In accordance with CEC regulations, this section of the application presents information on the paleontological resources of the region and site vicinity encompassed by the proposed Colusa Power Plant (CPP) Project. Paleontological resources, or fossils, are the remains of ancient plants and animals, as well as traces such as burrows or tracks, that can provide scientifically significant information on the history of life on earth. Assessments of the scientific significance of these remains are based on whether they can provide data on the taxonomy and phylogeny of ancient organisms, the paleoecology and nature of paleoenvironments in the geologic past, or the stratigraphy and age of geologic units. Fossils need not be mineralized to be of scientific significance. In areas that include geologically recent sedimentation, such as that in the current project area, the bones of extinct Pleistocene megafauna are frequently unaltered and not mineralized.

This section describes the potential for paleontological resources in the area, provides an assessment of potential impacts to paleontological resources, and provides mitigation measures to reduce potentially significant impacts to less-than-significant levels. The analysis complies with standards and guidelines recommended for the assessment and mitigation of impacts to paleontological resources recommended by the Society of Vertebrate Paleontology (1994). Archival research, subsequent field survey, and assessments were made under the direction of URS project paleontologist Mr. David Lawler. The data, impact assessments, and mitigation recommendations presented in this section are based on the *Paleontological Resources Technical Report, including Scientific Literature Review, Site Records/Specimen Survey, prepared by Mr. Lawler for Reliant Energy, Colusa Power Plant Project, Colusa County, California* (Appendix R: submitted separately under rules of confidentiality).

The final portion of this section describes laws, ordinances, regulations, and standards (LORS) relevant to paleontological impacts of the project as well as the contacts in pertinent regulatory agencies. Required permits are also discussed.

8.16.1 Affected Environment

The CPP project area is located in northernmost Colusa County adjacent to the Glenn County line, in northern California. It is approximately 4 miles northwest of the historic settlement of Delevan and near the municipality of Maxwell, west of I-5 (see Figure 8.16-1). The topography consists of low rolling hills and basins that flank the northwest portion of the Sacramento Valley region. The hills and ridges to the west of the project area represent prominent, erosional resistant landforms.

The various proposed and existing linear power facilities and power plant site areas and substations are shown on the Site Plan, Figure 3.3-1, and can be described as follows.

Plant and Switchyard Area

The proposed plant is located in the southern portion of the 200-acre project area. The plant facility and switchyard area and construction laydown areas encompass approximately 62.2 acres.

Transmission Line Interconnection Routes

The proposed transmission line interconnection corridor will interconnect the plant site and run northeasterly to the existing north-south oriented electrical transmission line system along the eastern edge of the project area. See Figure 3.3-1.

Water Supply Pipeline Route

The proposed 2,300-foot-long underground water supply pipeline will extend from an intake structure on the east side of the existing Tehama-Colusa Canal and will transport water easterly to connect with the power plant.

Natural Gas Pipeline

This approximately 2,500-foot-long underground natural gas fuel line will connect to an existing natural gas pipeline on the southeastern side of the PG&E Compressor Station site, then run along the southerly edge of the Compressor Station, turn northwesterly and connect to the power plant.

Teresa Creek Bridge

This bridge structure traverses a small tributary drainage of Hunter Creek and is located roughly 2 miles southeast of the plant site. Proposed construction will replace the bridge structure and require subsurface disturbance of in situ Quaternary alluvial (*Qal*) deposits. No fossil materials were observed during the field survey.

McDermott/Delevan Road Intersection

The road intersection is located roughly 2 miles southeast of the plant site. Proposed construction and relocation of the existing stop sign and telephone conduit box at the northeastern corner of the intersection will require shoulder widening to be accomplished by placement of gravel along the northeast and southeast corners of the intersection to allow for turning movements by wide body trucks. This activity may require subsurface disturbance of in situ *Qal* deposits. No fossil materials were observed during the field survey.

8.16.1.1 Geology and Stratigraphy

Surficial sedimentary units ranging from Mesozoic to Pleistocene and Holocene ages underlie the entire project area. Corresponding sedimentary depositional environments range from continental, including alluvial, fluvial, estuarine, terrace, and fan-derived sediments, to subaerial floodplain to marine. Lithologies include sand, gravel, silt, and clay, all of which are potentially favorable to the preservation of paleontological resources.

Rock outcrops ranging from Cretaceous to Pleistocene age occur as surficial and subsurface deposits along the western edge of the northern Sacramento Valley area. These deformed and faulted sequences of sedimentary units have been described and mapped previously by Atwater (1982), Bartow (1987), Blake et al. (1974), Brabb et al. (1971), Brown and Rich (1961), Jennings and Strand (1960), Sims et al. (1973), and Weaver (1949). In addition, Graymer and Helley (1997) have described the geomorphic development of the successive series of Pleistocene marine terraces that have been subsequently dissected by the major west-flowing Sacramento River drainage. The lateral extent of these *Qal* subunits are recognized from geological mapping data in the northern Sacramento Valley by Helley and Harwood (1985).

For paleontological sensitivity purposes, the Upper Cretaceous marine sedimentary rocks identified as 8a, 8b, 9a, 9b, 9c, and 9x in Figure 8.15-4 are combined and considered as one paleontologic unit (*Ku*). The Quaternary subunits of *Qrb*, *Qrl*, *Qa*, and *Qb*, identified on the geologic map (Figure 8.15-2) are also combined and are considered as one paleontologic unit (*Qal*).

While Quaternary alluvium deposits of Pleistocene age occur locally within the project area, usage of the *Qal* geologic symbol designation on available geologic maps is highly variable. Geologic units ranging from Quaternary age stream, terrace, fluvial, and alluvial fan and floodplain deposits may be lumped

under this designation, particularly where geologic data have been scarce (see Helley and Harwood, 1985; Jennings and Strand, 1960; Olmstead and Davis, 1958).

The Quaternary rock units vary in facies type from conglomerate to sandstone to unconsolidated siltstone and clay, all of which are either fossiliferous or potentially fossiliferous.

Weak to strong structural folding of the entire Mesozoic to Pleistocene age geologic section within and immediately adjacent to the project area has been documented by structural geological studies as well as oil and gas investigations (Brown and Rich, 1961; Helley and Harwood, 1985; MacKevett, 1985).

Gradual, long-term erosion and previous construction activity has removed parts of the Recent soil cover so that these Quaternary rock units and their contained fossils are now at or near the surface throughout most of the proposed project area. These formations or parts of the formations now exist at or near the surface with varying width across the project area terrain, but are obscured in most areas by soil, vegetation, or thin deposits of surficial sediment. Thus, visual detection of fossils is only possible in those areas where natural erosion or man-made excavations during road, pipeline, or building site excavation or grading operations have removed this cover.

The majority of the project area is underlain by both Upper Cretaceous age marine sedimentary rocks (*Ku*) and Quaternary age deposits (*Qal*). Given this fact, the potential paleontological sensitivity of a particular site within the proposed project has been determined from the distribution of known nearby fossil localities and available geologic mapping.

8.16.1.2 Paleontological Sensitivity of the Proposed Project Area

The following sections discuss the paleontologic sensitivity of the geologic units identified in the proposed project area. Three categories of paleontological potential are used in this report according to California Energy Commission standards. Rating categories are to be considered interpretive and subject to change as new information is obtained. High Potential, Moderate Potential, and Low Potential ratings are defined as follows:

- **High Potential Rating.** Rock units with a high potential for significant paleontological resources are known to have yielded vertebrate fossils within the project area or region. This does not necessarily imply that vertebrate fossils will always be recovered from rock units rated as having high potential, but only that there are recorded occurrences within the unit. Additional factors that are considered pertain to inferred depositional environment and lithology.
- **Moderate Potential Rating.** Rock units possessing some degree of potential such as favorable depositional environment for resource preservation or lithologically similar rock units in the region have yielded vertebrate fossils. All moderate potential-rated rock units are recommended for field survey and construction monitoring.
- **Low Potential Rating.** Rock units containing lithologies that do not commonly preserve significant fossil resources (i.e., coarse conglomerates, welded or ignimbrite volcanic ash deposits) are considered to have low potential. Igneous rocks, such as the granodiorite outcrops in the northern part of the project area, are precluded from preservation of paleontological resources, due to their genesis within a magmatic environment.

MESOZOIC SEDIMENTARY ROCK UNITS

Upper Cretaceous Sedimentary Deposits (*Ku*)

The Upper Cretaceous age sedimentary deposits represent the oldest rocks in the proposed project area. These have been assigned to the Great Valley Sequence. These units are overlain by Quaternary age deposits or adjacent to incised stream cut areas; colluvium and/or Quaternary sediments may exceed 30 feet in thickness.

Camp (1942) has described a fossil marine reptile (ichthyosaur) partial skull discovered in the Diablo Range to the south that is believed to have eroded out of Franciscan age sediments and may have been reworked into Cretaceous sediments prior to its deposition and subsequent discovery in Quaternary alluvium.

The Great Valley Sequence has been summarized by Kirby (1943) and Brown and Rich (1961) and represents a complex series of massive sandstones and turbidite deposits. Brown and Rich (1960) report that Early Cretaceous marine invertebrate fossils were found in submarine slumps or turbidite deposits of Late Cretaceous age. Hertlein (1951) reports on Cretaceous marine invertebrate fossil localities in age-equivalent rocks in the San Francisco Bay region.

CENOZOIC ROCK UNITS

Quaternary Undifferentiated (*Qal*)

Over 100 years of fossil vertebrate collecting in the Sacramento Valley – Bay-Delta Region has produced one of the most extensive databases for understanding the fossil vertebrate record of the northern California coastal region. Only the southern California – Los Angeles Basin – Newport Beach area has yielded as much information on the Pleistocene coastal vertebrates of North America (see Langenwalter, 1975). The first record of a fossil vertebrate from this region was a fossil mammoth tooth from the San Pablo Bay area, as reported by Blake (1855).

Although other Pleistocene age fossil vertebrate sites are known elsewhere than in the San Francisco Bay region of California (Stirton, 1939, 1951; Savage, 1951; Jefferson, 1991), the Montezuma Formation (the geological equivalent unit) vertebrate sites in the Hercules-Rodeo districts have yielded the most significant microvertebrate material. This diverse microvertebrate fauna has been extensively studied most recently by Wolf (1971, 1973, and 1975) and consists of numerous small mammals including lagomorphs (rabbits), rodents, insectivores and a variety of birds and lower vertebrates (frogs, lizards and snakes). Many of the fossil specimens represent the best-preserved specimens of particular taxa found to date.

In comparison, the La Brea Tar Pit fossil mammal assemblage of upper Pleistocene age in the Los Angeles Basin is well known world-wide. It is derived from the Palos Verdes Sand (upper part of Arnold's San Pedro Formation) in the northwestern portion of the Los Angeles Basin. This assemblage includes a wide variety of carnivores (canids and felids), small to large ungulate herbivores (cervids, antilocaprids, camelids, equids, suids), edentates (sloths), birds, rodents, and lower vertebrates. Also found at these sites are aquatic mammalian taxa, including otter, whale, and dolphin, as well as shark and teleost fish taxa (Miller, 1971).

Paleontological localities occurring in both rock units *outside* the one-half-mile radius of the project area but within the Sacramento Valley – Bay-Delta region contain scientifically important paleontological resources that represent a wide variety of terrestrial and aquatic vertebrate taxa, including camel, bison, and rodent terrestrial mammalian taxa (see University of California Museum of Paleontology (UCMP) confidential fossil locality and specimen data – Lawler, 2001). The sandstone, silt, and clay lithologies of

both geologic units are favorable for exceptional preservation of vertebrate and microvertebrate fossil resources. These localities have been assigned to the Pleistocene Quaternary alluvium (*Qal*) unit.

No paleontological sites are known to exist within one-half-mile of the project area. However, regionally, fossil mammal assemblages have been collected from the Montezuma Hills area to the south (e.g., UCMP V3719,V79073), in the San Francisco Bay-Delta Area (UCMP 1359,1363), and to the south in the Antioch area (Lawler, 2001). Both the Antioch and Martinez river margin areas have produced significant fossil proboscidian (elephant), camel, sloth, and bison (buffalo) specimens.

The geology of the *Qal* Rodeo deposit has been recently described by Wolf (1975). All data reviewed corroborate the existence of a Quaternary age alluvial unit (*Qal*) within the project area.

No other projects with a designated paleontological component are known to have conducted previous field or literature surveys or produced sensitivity maps or reports within or adjacent to the CPP Project.

HOLOCENE AND POST-HOLOCENE AGE SEDIMENTS

Sediments of probable Holocene or post-Holocene age that form the thin, surficial cover are considered to be of limited paleontological interest and thus are considered inconsequential.

PALEONTOLOGICAL SENSITIVITY ANALYSIS

The sensitivity ratings shown on Table 8.16-1 are arranged by rock unit; in this instance the (*Qal*) Quaternary alluvium and (*Ku*) Upper Cretaceous rock units are the only geological units of significance. Analysis of pre-construction field survey data, museum record and specimen collections, and distribution of known regional fossil localities has permitted classification of paleontological resource sensitivity areas. This methodology provides delineation of areas likely to contain fossils in particular types of sedimentary rocks.

It should be noted that sensitivity ratings may change as future paleontological resource surveys are undertaken. Identification of significant vertebrate or microvertebrate sites and materials of scientific significance may elevate the paleontological resource rating of a particular rock unit.

Table 8.16-1 summarizes the paleontological sensitivity rating for all proposed project linear power facilities and associated infrastructure. This information is also graphically depicted on Figure R2 in Appendix R (submitted separately under rules of confidentiality).

Plant and Office Switchyard Area

The power plant site and switchyard are assigned a Moderate-High sensitivity rating, because shallow excavations are predicted to penetrate into the Upper Cretaceous (*Ku*) unit. A maximum excavation depth of 25 feet is estimated.

Construction Laydown Area

The construction laydown area is also assigned a Moderate-High sensitivity rating, because shallow excavations are predicted to penetrate into both the Quaternary alluvium (*Qal*) and Upper Cretaceous (*Ku*) units.

Transmission Line Interconnection Corridor

The transmission line corridor is also assigned a Moderate-High sensitivity rating, because shallow excavations are predicted to only penetrate into the *Qal* unit. Discovery of resources may occur during construction when transmission tower foundations are excavated.

Water Supply Pipeline

The water supply pipeline route is also assigned a Moderate-High sensitivity rating, because shallow excavations are predicted to penetrate into both *Qal* and *Ku* units. A maximum excavation depth of 6 to 8 feet is estimated for the majority of the pipeline route.

Natural Gas Pipeline

The natural gas pipeline route is also assigned a Moderate-High sensitivity rating, because shallow excavations are predicted to penetrate into the *Ku* unit. A maximum excavation depth of 6 to 8 feet is estimated for the majority of the pipeline route.

Teresa Creek Bridge

New construction related to replacement of the Teresa Creek Bridge may impact vertebrate fossils if excavation and grading disturb the *Qal* unit. A High sensitivity rating is assigned.

McDermott/Delevan Road Intersection

Minor improvements related to relocation of the stop sign and telephone conduit box at this road intersection may also potentially disturb older in situ *Qal* deposits. A High sensitivity rating is assigned.

8.16.2 Environmental Consequences

Significance criteria were established that follow CEQA Guidelines (Appendix G, Environmental Checklist, approved January 1999), on performance standards and thresholds adopted by agencies charged with management of these resources and compliance oversight, and guidelines adopted by the Society of Vertebrate Paleontology (1994). An impact may be considered significant if the project results in:

- Disturbance or destruction of an intact fossil bed in a manner such that its scientific data and educational potential would be lost or destroyed;
- The scientifically uncontrolled removal, or destruction, of identifiable vertebrate invertebrate, or paleobotanical remains; or
- The disturbance or destruction of a unique paleontological resource or site.

Construction of the proposed project would impact both the Mesozoic sedimentary rocks and the Quaternary alluvial and basin deposits. Both of these units have been assigned Moderate to High paleontologic sensitivity ratings. Therefore, construction-related excavations within these sedimentary units have the potential to impact significant paleontologic resources. These impacts would include the destruction of nonrenewable paleontological resources as a consequence of disturbance by earth-moving machinery, and the consequent loss of their scientific data and educational potential.

8.16.3 Cumulative Impacts

In addition to the CPP, other projects in the area are in the planning stages that may have similar impacts to the paleontological resources of the Sacramento Valley. These projects include a proposal for an underground reservoir for storage of natural gas that would connect to the PG&E Compressor Station adjacent to the CPP project site. Additionally, there is a proposal for a surface water reservoir near Sites, California, which is located in the foothills southwest of the project area. If these projects do come to fruition, the responsible parties would be required to conduct paleontological resource assessments and

identify and implement mitigation measures that would effectively recover the value to science of significant fossils recovered if they were properly carried out. Therefore, it is unlikely that there would be a cumulative impact from this project and the other proposed projects that would result in significant, adverse impacts to paleontological resources in the Sacramento Valley area.

8.16.4 Mitigation Measures

In order to mitigate the potential for impacts from earth-moving machinery and construction-related excavations, the following mitigation measure will be implemented.

PALEO-1 Monitoring

Those areas containing geologic units designated with a potentially Moderate or High sensitivity rating shall be monitored by an onsite construction monitor trained by a professional paleontologist when initial ground disturbance occurs to ensure that subsurface paleontological resources are adequately assessed as to their significance. If deemed significant, these should be salvaged according to professional paleontological standards (e.g., Society of Vertebrate Paleontology standards).

Field monitoring activities will include:

1. Pre-construction meetings with key construction personnel to provide brief discussions pertaining to paleontological resource significance, visual identification, and discovery notification procedures.
2. Assembly of representative collections of significant paleontological resources.
3. Removal of bulk matrix samples to sample and extract microvertebrate fossil remains by screenwashing process methods and subsequent fossil concentrate sorting, identification, and curation.
4. Laboratory preparation of significant non-microvertebrate paleontological specimens and preliminary identification and curation of these specimens.
5. Curation of fossil specimens into a state-designated scientific repository. Locality data are regarded as confidential (for protection of the resources). Detailed information shall be provided to those responsible for reviewing museum archival and curatorial data.

A professional paleontologist shall prepare and conduct a training program designed to educate employees engaged in earth-disturbing activities and how to recognize potential paleontological resources. The training program shall include specific reporting requirements for employees that may discover potential paleontological resources. Employees shall report potential discoveries to the paleontological monitor, who shall contact the professional paleontologist if warranted.

With implementation of Mitigation Measure PALEO-1, impacts to paleontological resources would be less than significant.

8.16.5 Laws, Ordinances, Regulations, and Standards

The proposed project will be constructed and operated in accordance with all laws, ordinances, regulations, and standards (LORS) applicable to geologic hazards and resources. LORS relevant to this project are summarized in Table 8.16-2 and are discussed briefly below.

8.16.5.1 Federal

The Antiquities Act (1906) and National Environmental Protection Act (NEPA) regulate disturbance to paleontological/prehistoric resources on federal lands. The overseeing agencies are the Federal Energy Regulatory Commission, U.S. Forest Service, and U.S. Bureau of Land Management. The regulations pertain to project direct or indirect impacts on unique paleontological resources or sites and apply to federal lands or federally funded projects. Resource conservation is stipulated.

8.16.5.2 State

The California Environmental Quality Act (CEQA) Guidelines regulate project direct or indirect impacts on unique paleontological resources or sites, requiring resource assessment, monitoring, and mitigation. The Secretary of Resources has deemed the CEC permitting process as a certified regulatory program demonstrating compliance with CEQA.

8.16.5.3 Local

No local agency regulations are known to apply to paleontologic resources.

8.16.6 Involved Agencies and Agency Contacts

Issue	Agency/Address	Contact/Title	Telephone
Paleontological resources	California Division of Mines and Geology, Office of the State Geologist 801 "K" Street Mail Stop 1230 Sacramento, CA 95814	Jim Davis, State Geologist	(916) 445-1923

8.16.7 Permits Required and Permit Schedule

This project does not require federal, state, or local permits for paleontological resource issues.

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Table 8.16-1 Colusa Power Plant Project Paleontological Sensitivity and Geologic Units	
Rock Formation	Sensitivity Rating
Plant Site	
<i>Ku</i>	Moderate-High
Laydown Area	
<i>Ku</i> and <i>Qal</i>	Moderate-High
Transmission Line Interconnection Corridor	
<i>Ku</i>	Moderate
Water Supply Pipeline	
<i>Ku</i> and <i>Qal</i>	Moderate-High
Natural Gas Pipeline	
<i>Ku</i>	Moderate
Teresa Creek Bridge	
<i>Qal</i>	High
McDermott/Delevan Road Intersection	
<i>Qal</i>	High

Table 8.16-2 Applicable Paleontological Resources Laws, Ordinances, Regulations, and Standards			
Laws, Ordinances, Regulations, and Standards	Administering Agency	Applicability	AFC Section
Federal			
SVP (Society of Vertebrate Paleontologists)	N/A	Paleontological Resources – Nationwide. Recommended set of procedures and standards for assessing and mitigating impacts to vertebrate paleontological resources (adopted October 1994).	8.16.2, 8.16.3, 8.16.4
State			
CEQA Guidelines (California Environmental Quality Act)	State California	Regulates industrial/ residential development projects. Project direct or indirect impacts on unique paleontological resources or sites — resource assessment, monitoring and mitigation required (superceded by CEC process).	8.16.2, 8.16.3, 8.16.4
Local			
None identified	—	—	—
CEQA = California Environmental Quality Act LORS = laws, ordinances, regulations, and standards N/A = not applicable NEPA = National Environmental Policy Act SVP = Society of Vertebrate Paleontologists			

